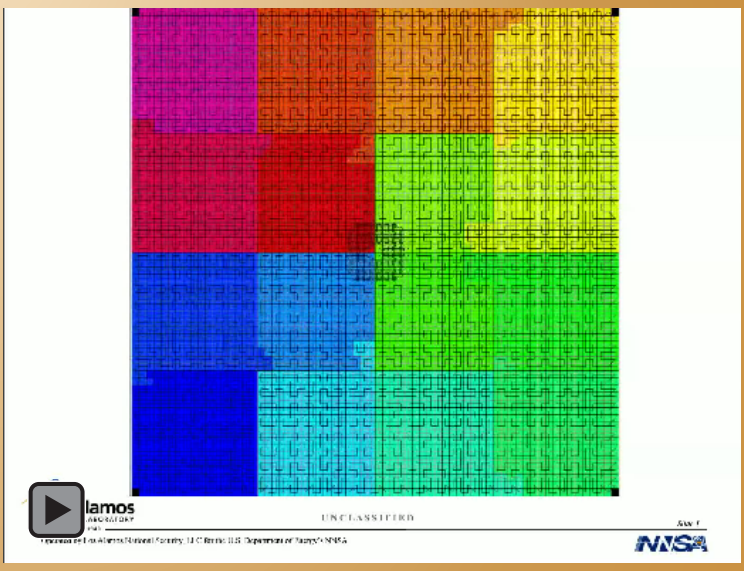
Cell-based Adaptive Mesh Refinement on the Graphics Processing Unit



Porting cell-based adaptive mesh refinement onto the GPU necessitates new programming algorithms, such as:

- Local space-filling stencils
- Hash-based neighbor searching
- Enhanced precision sums

The performance gains look promising:

Function	CPU (s)	GPU (s)	Speedup
Timestep Calc	2.30	.068	33.79
Apply BCs	.546	1.76	81.0
Finite Difference (TVD)	141.81		
Refinement Potential	3.18	.142	22.46
Rezoning	1.87	.568	3.30
Partitioning	.177	0	---
Mass Sum (Kahan)	.676	.041	16.48
Write to Device	0	.0417	---
Read from Device	0	.0083	---
Total	150.56	2.63	57.32

Robert Robey, brobey@lanl.gov
David Nicholaeff, dnic@lanl.gov

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